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Beamstrahlung Light Detection via Image Analysis in the LABM Detector

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Abstract

This work presents an automated processing pipeline for analyzing multichannel images taken by the *Large Angle Beamstrahlung Monitor* (LABM), installed at the SuperKEKB particle collider in Japan. The main goal is to develop methods to develop qualitative and quantitative methods to distinguish the beamstrahlung radiation from synchrotron radiation, in order to provide operational metrics to optimize beam collimation and coupling in the accelerator.

Approximately 400 RGB images from the LABM detector cameras were processed. The main workflow uses a relative global threshold based on luminance percentiles, enabling segmentation of the maximum intensity spot (blob) without manual intervention. This approach reduces the processing time to 0.31 seconds per frame.

The analysis reveals optical misalignments and persistent hot pixels in specific sensors. The proposed framework establishes a foundation for quantum efficiency and beam-size studies, paving the way toward almost real time beamstrahlung-synchrotron separation.

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